Rocky Flats Environmental Technology Site
Actinide Migration Studies
Meetings July 7-8, 1999
Advisory Group Greg Choppin, David Clark, David Janecky, Leonard Lane

Results and Discussions

Solar Ponds

The discussion of the treatability studies and the volumes of nitrate and uranium involved was very informative The isotopic data on uranium from High Resolution ICP/MS indicate that uranium really has not moved much from where it was originally deposited While uranium was initially placed in the ponds in the form of uranyl nitrate, subsequent precipitation is likely to have occurred, rendering the uranium *relatively* immobile For sample sites just below the plume extent indicated by the HR ICP/MS analyses, the value of a baseline analysis using Thermal Ionization Mass Spectrometry (TIMS) should be evaluated

Update on Redox Experiments

As part of the redox experiment studies, a hypothesis was developed regarding the potential to generate reducing conditions by microbiota Soil cores were taken from a B series pond and the interceptor ditch Pond soils showed a change in E_h ranging from +0 96 mV at the water-sediment interface to –190 5 mV at 4 inches below the interface This latter reducing potential was similar to that reached by Honeyman in laboratory redox cell experiments Sediments were sealed in columns with and without nutrients and a carbon source Four soil cores were "sterilized" using gamma radiation at Oregon State University to kill any microbiological activity and serve as experimental blanks The columns were heated to 35C to rapidly generate microbiological activity Samples were taken (nominally with sterile technique) and monitored for "operational solubility" of redox sensitive metals (Fe and Mn) as judged by 0 45um filter passing experiment

The samples were incubated for up to 24 days and then stopped The largest reducing potential was found to be –380 mV with pH values approaching 6 8 Dissolved iron "operationally defined" was observed, and Fe^{2+} was quantified using a bipyridine titration to form an Fe(II) bipyridine complex Manganese concentrations also were found to increase, but the Mn oxidation state was not quantified These experiments demonstrate nicely that one can generate reducing conditions, and that such conditions can cycle the oxidation states of Fe and Mn from pond sediments and interceptor ditch soils The observed redox cycling of Fe and Mn was anticipated from the work of Werner Stumm, and the present data illustrates that cycling can take place at RFETS Of real interest for the migration of plutonium, is whether these reducing conditions will result in the eventual release of plutonium At the July meeting, we didn't know anything about Pu concentrations, but these data will be available at the close of the project, at which time this important relationship will be known There are also some additional questions regarding experimental technique, but we feel that we should wait for the final report for a full experimental writeup

SW-A-004963

Industrial Area Strategy (Environmental Remediation)

Lane Butler gave an overview of the Industrial Area Strategy The main drivers for the strategy were future land use and protection of surface water quality There is relatively good recognition that there is a balance that needs to be found between site characterization and environmental restoration However, there are some potential pitfalls with respect to the coupling of D&D with ER activities

Conceptual Model and future developments

The Conceptual Model and its presentation on the afternoon of July 7, 1999 went well and prompted the Advisory Board to suggest to Christine Dayton to consider bring a polished version of the Conceptual Model to a web site for broader dissemination within the Site and to the public We feel this is necessary because of the central role the Conceptual Model plays in coordination of Site activities and in communicating with the public

903 Pad Characterization Results and Path Forward for Remediation

The data set obtained from field HPGe measurements and laboratory measurements of soil samples is excellent The RFETS team is encouraged to apply krigging methods to this data set to refine and evaluate the direct analysis of soil contamination and uncertainties in this area as it relates to remediation approaches and decissions

Tours: Old Landfill, 800 area

A tour was conducted for the actinide chemists of the advisory group We visited the original landfill and discussed its past history and future disposition We then visited a series IHSS sites in the 800 area Of particular interest were process waste leaks, drum storage areas, footing drain outfall, and status of sumps

Tours: Buffer Zone and Erosion Modeling sites

We visited gauging sites with water quality sampling on Woman Creek The flow is measured with Parshall flumes and pump samples are taken with and Isco pump sampler which collects water samples for determination of suspended sediment concentrations Notable were the flow gaging capacities of these sites, estimated by Win and Greg to be on the order of the 2 to 5 year return period peak discharge rates If this is the general case of flow monitoring sites, the monitoring network may be under-designed with regard to calibrating the WEPP model over a range of representative flow rates In an attempt to ascertain if this informal observation is accurate, on behalf or the Advisory Board I have asked for descriptive tables of the flow monitoring sites indicating the site description, location, period of record, mean and standard deviation of annual runoff volumes, etc Also, we request DQOs and written QA/QC procedures for the hydrologic data collection and processing activities The purpose of these tables and the data they contain is to allow an overview of the hydrologic network and its

adequacy for monitoring a sufficient time series of runoff rates and volumes and sediment concentration/yield data to assist in calibration of the WEPP soil erosion model

Additional sites such as the diversion ditch below Pad 903 and the A, B, and C series of ponds were observed and their role in trapping sediment and associated contaminants was discussed Maps of the site showing these facilities were obtained and will be used to raise further questions on the erosion and transport modeling as appropriate

Introduction to D&D and Concrete Leaching Studies (Industrial Area Strategy)

The strategy for D&D activities in the Industrial Area was presented for the 2006 closure plan The integration and handoffs between D&D and ER are getting some attention, and we will continue to evaluate this interface One area raised by during the D&D presentation is the stability of contaminated concrete, particularly for plutonium This problem is parallel to the plutonium in soils and sediments question on which the Actinide Migration Evaluation group has spent considerable effort Review of the BNFL report on the behavior of buried contaminated concrete indicates two major knowledge gaps (1) the crystallinity of plutonium solid phase is a crucial unknown factor in determining the mobility and solubility, and (2) all of the collected previous laboratory experimental work has determined solubility from supersaturation and for fresh precipitates of aqueous plutonium Freshly precipitated plutonium as hydroxide and/or oxyhydroxide results in solubilities identical to those reported in the BNFL report on the order of 10^{-9} moles/L (approximately $2x10^{4}$ pCi/L), while the thermodynamic solubility of crystalline PuO_2 is approximately 10^{-17} moles/L ($2x10^{-4}$ pCi/L) [Efurd and others, 1998, ES&T v32, p3893] At least two sources of plutonium contamination of concrete can be identified at Rocky Flats (particulate transport during fires and solution spills), and all of the material has aged substantially in a relatively uncontrolled environment The chemistry and state of these plutonium contaminants can be evaluated using state of the art spectroscopy, supported by other conventional laboratory and material science characterization tools, to provide information on the detailed structural and spatial distribution of actinide and cement products

Documents provided to advisory group

Solar ponds plume viewgraphs
Water quality-monitoring memo of June 21, 1999
Industrial area characterization and remediation strategy view graphs
Notes on experimental work of Ranville and Honeyman
Harnish, McKnight and Ranville (1994) USGS WRI Report 93-4175
Summary of 2006 Rocky Flats closure project baseline A brief overview
Response to Kirk Nordstrom data action items identified on May 12, 1999
A literature review on the behavior of buried contaminated concrete over time and relevance to plutonium, americium and uranium contamination at the Rocky Flats Environmental Technology Site BNFL, Inc report submitted to RMRS

Documents and information requested for advisory group

For surface water monitoring data from 3/23/94 to 10/28/97, we have previously received plutonium and americium concentrations and uncertainty data from the RFETS databases Is there corresponding flow rates, flow volumes, and TSS data for these samples and locations that can be provided electronically?
For surface water monitoring data since 10/28/97, a similar data set by location, date, and sample number for plutonium, americium, flow rates, flow volumes, and TSS (amount and uncertainty) is requested

Participants in AMS technical meetings

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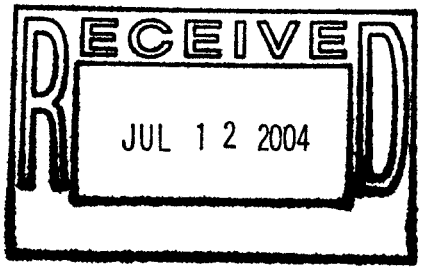

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